Diode-side-pumped, continuous-wave Nd:YVO_4 self-Raman laser at 1176nm based on DBMC technology

Cristine C. Kores[1], Dimitri Geskus[2], Helen M. Pask[3], Niklaus U. Wetter[1]

1. *Centro de Lasers e Aplicações, IPEN-CNEN/SP, Av. Professor Lineu Prestes 2242, 05508-000 São Paulo (SP), Brazil*
2. *Department of Materials and Nano Physics, KTH - Royal Institute of Technology, Kista, 16440, Sweden*
3. *MQ Photonics, Department of Physics and Astronomy, Macquarie University, Sydney, NSW 2109, Australia*

Intracavity Raman lasers provide a practical way to access hard to reach wavelengths by transforming the fundamental wavelengths into longer ones through stimulated Raman scattering (SRS) and, using nonlinear conversion processes, up-converting them into the visible, ranging from blue to red [1,2]. In a self-Raman laser, the fundamental and the Raman laser oscillation are both generated in the same crystal, enabling a compact laser cavity with less optical interfaces and subsequent lower losses.

In this work we demonstrate for the first time, to our knowledge, cw operation of a side-pumped Nd:YVO_4 self-Raman laser. This was achieved by using a grazing incidence geometry for the laser beam [3] together with the DBMC (double beam mode controlling) technique [4,5,6]. This is a side-pumping technique, in which the laser beam suffers two total internal reflections at the pump facet of the crystal (Fig. 1a) [7]. Within this set-up, the two beams compete for the same gain region, decreasing the laser mode size and favouring TEM_{00} mode oscillation [4]. In band pumping of the crystal at 880 nm was employed, to minimize thermal load of the crystal.

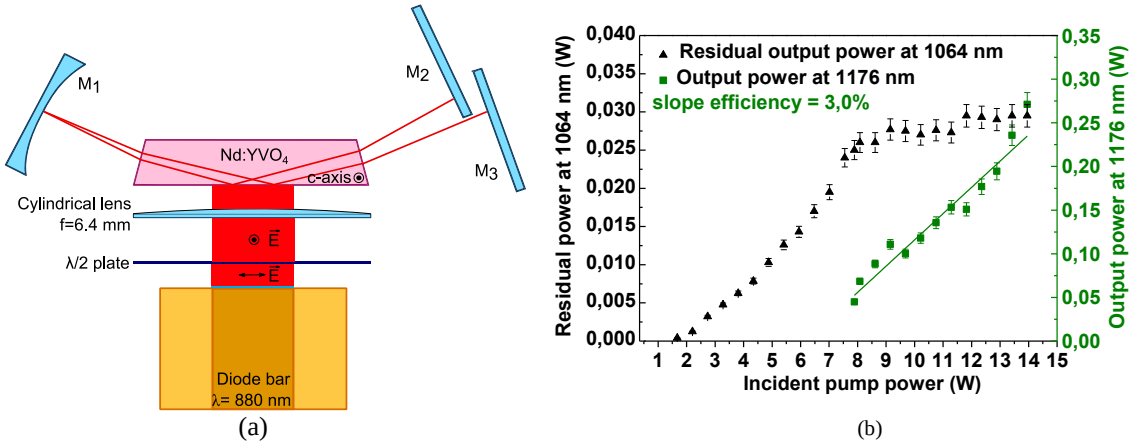

Fig. 1 (a) The DBMC configuration used in this work, in which the coatings of the mirrors M_1 and M_2 are HR@1064&1176nm; mirror M_3 has HR@1064nm, T@1176nm=0,45%. (b) Fundamental mode output power at 1176 nm as function of the pump power.

We obtained stable continuous-wave TEM_{00} operation at 1176 nm, providing a conversion efficiency (pump radiation to Stokes radiation) of 1.94%, with single mode TEM_{00} laser operation. The residual power at 1064 nm was also measured (at M_1), in order to monitor how it behaves as the Stokes field increased. The fact that the fundamental output power does not increase significantly is an indicator for the absence of severe line-broadening which is detrimental to the laser efficiency [8].

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